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**METHOD AND APPARATUS FOR FORMING IMAGE**

**[Abstract]**

15 **PURPOSE:** To prevent an ink and a toner in the peripheral part of an image from flying and wrinkles on a recording paper caused by superposition of the ink and the toner from being generated when a black image is output as a color image.

**CONSTITUTION:** For example, when a square of 8 dots × 8 dots is output as  
20 a black image, at first, the image data of 8 dots × 8 dots is developed with a black component (Bk) in an image memory 106. Then, as each image element in the region of 6 dots × 6 dots in the square, image data are developed on each memory plane in such a way that the image data are overlighted by using two color components among the Bk component and  
25 each color component (cyan (C), magenta (M) and yellow (Y)) to falsely form

**a black image.**

**[Claims]**

**[Claim 1]** A method for forming an image which receives a command described by a page description language from a host computer, displays a color image obtained by the command on a memorizing medium, and  
5 outputs the color image to a recording medium by using an ink or toner, the method comprising: when the displayed image is obtained, a command interpreting process for discriminating whether the color image is a black image by interpreting the contents of the command; when the color image is the black image, a first image formation commanding process for  
10 commanding image formation using a black color element; and a second image formation commanding process for commanding black image formation using another color element inside the contour of the image formation area formed by the first image formation commanding process.

**[Claim 2]** A method for forming an image which receives a command  
15 described by a page description language from a host computer, displays a color image obtained by the command on a memorizing medium, and outputs the color image to a recording medium by using an ink or toner, the method comprising: when the displayed image is obtained, a command  
20 interpreting process for discriminating whether the color image is a black image by interpreting the contents of the command; when the color image is the black image, a first image formation commanding process for commanding image formation using a black color element; and a second  
25 image formation commanding process for commanding pseudo-black image formation inside the contour of the image formation area formed by the first image formation commanding process without using all color elements for

color representation.

[Claim 3] An apparatus for forming an image which receives a command described by a page description language from a host computer, displays a color image obtained by the command on a memorizing medium, and  
5 outputs the color image to a recording medium by using an ink or toner, the apparatus comprising: a receiving means for receiving the command; when the displayed image is obtained, a command interpreting means for discriminating whether the color image is a black image by interpreting the contents of the command; when the color image is the black image, a first  
10 image formation commanding means for commanding image formation using a black color element; a second image formation commanding means for commanding black image formation using another color element inside the contour of the image formation area formed by the first image formation commanding means; an image forming means for forming the image on the  
15 memorizing means by the command from the first image formation commanding means and the second image formation commanding means; and an output means for outputting the image formed on the memorizing means.

[Claim 4] An apparatus for forming an image which receives a command  
20 described by a page description language from a host computer, displays a color image obtained by the command on a memorizing medium, and outputs the color image to a recording medium by using an ink or toner, the apparatus comprising: a receiving means for receiving the command; when the displayed image is obtained, a command interpreting means for  
25 discriminating whether the color image is a black image by interpreting the

contents of the command; when the color image is the black image, a first image formation commanding means for commanding image formation using a black color element; a second image formation commanding means for commanding pseudo-black image formation inside the contour of the  
5 image formation area formed by the first image formation commanding means without using all color elements for color representation; an image forming means for forming the image on the memorizing means by the command from the first image formation commanding means and the second image formation commanding means; and an output means for  
10 outputting the image formed on the memorizing means.

**[Title of the Invention] Method and Apparatus for Forming Image**

**[Detailed Description of the Invention]**

**[0001]**

**[Field of the Invention]** The present invention relates to a method and  
5 apparatus for forming an image, and more particularly to, a method and  
apparatus for forming an image which receives a page description language  
(hereinafter, referred to as 'PDL') such as PostScript(TM) from a computer,  
and displays and outputs a color image.

**[0002]**

10 **[Description of the Prior Art]** A conventional apparatus for processing a  
color image which receives a PDL, displays a color image, and outputs the  
color image to a color printer displays characters and figures designated by  
colors (cyan, crimson, yellow, black, red, green and blue) designated by the  
PDL in a designated position with a designated size.

15 **[0003]**

**[Problems to be Solved by the Invention]** However, when the conventional  
apparatus generates a black character font figure, the four color toner inks  
including cyan, crimson, yellow and black overlap with each other, thereby  
causing (1) color non-uniformity in the character contour, and (2) paper folds  
20 by dispersion of the toner or spreading of the ink.

**[0004]** The present invention is achieved to solve the above problems. An  
object of the present invention is to provide a method and apparatus for  
forming an image which can prevent color non-uniformity of an image  
contour or folds of a recording medium.

25 **[0005] [Means for Solving the Problem]** In order to achieve the

aforementioned object of the present invention, there is provided a method for forming an image which receives a command described by a PDL from a host computer, displays a color image obtained by the command on a memorizing medium, and outputs the color image to a recording medium by using an ink or toner, the method including: when the displayed image is obtained, a command interpreting process for discriminating whether the color image is a black image by interpreting the contents of the command; when the color image is the black image, a first image formation commanding process for commanding image formation using a black color element; and a second image formation commanding process for commanding black image formation using another color element inside the contour of the image formation area formed by the first image formation commanding process.

[0006] According to another aspect of the present invention, there is provided a method for forming an image which receives a command described by a PDL from a host computer, displays a color image obtained by the command on a memorizing medium, and outputs the color image to a recording medium by using an ink or toner, the method including: when the displayed image is obtained, a command interpreting process for discriminating whether the color image is a black image by interpreting the contents of the command; when the color image is the black image, a first image formation commanding process for commanding image formation using a black color element; and a second image formation commanding process for commanding pseudo-black image formation inside the contour of the image formation area formed by the first image formation

commanding process without using all color elements for color representation.

According to yet another aspect of the present invention, there is provided an apparatus for forming an image which receives a command described by  
5 a PDL from a host computer, displays a color image obtained by the command on a memorizing medium, and outputs the color image to a recording medium by using an ink or toner, the apparatus including: a receiving means for receiving the command; when the displayed image is obtained, a command interpreting means for discriminating whether the  
10 color image is a black image by interpreting the contents of the command; when the color image is the black image, a first image formation commanding means for commanding image formation using a black color element; a second image formation commanding means for commanding black image formation using another color element inside the contour of the  
15 image formation area formed by the first image formation commanding means; an image forming means for forming the image on the memorizing means by the command from the first image formation commanding means and the second image formation commanding means; and an output means for outputting the image formed on the memorizing means.

20 [0007] According to yet another aspect of the present invention, there is provided an apparatus for forming an image which receives a command described by a PDL from a host computer, displays a color image obtained by the command on a memorizing medium, and outputs the color image to a recording medium by using an ink or toner, the apparatus including: a  
25 receiving means for receiving the command; when the displayed image is



obtained, a command interpreting means for discriminating whether the color image is a black image by interpreting the contents of the command; when the color image is the black image, a first image formation commanding means for commanding image formation using a black color element; a second image formation commanding means for commanding pseudo-black image formation inside the contour of the image formation area formed by the first image formation commanding means without using all color elements for color representation; an image forming means for forming the image on the memorizing means by the command from the first image formation commanding means and the second image formation commanding means; and an output means for outputting the image formed on the memorizing means.

[0008]

[Operation]

In accordance with the present invention, in the case that the black image is formed according to the interpreted result of the command described by the PDL, when the displayed image is obtained, the image is formed in the black image formation area by using the black color element, and the black image is formed in the contour of the area by using another color element, or the pseudo black image is formed in the contour of the area without using all color elements for color representation.

[0009]

[Embodiment of the Invention] The preferred embodiments of the present invention will now be described in detail with reference to the accompanying drawings.

**[0010]**

**[Explanation of Common Embodiment (Fig. 1)]** An apparatus for forming an image that is commonly used for the following three embodiments will now be explained. Fig. 1 is a block diagram illustrating the apparatus for forming the image that is the representative embodiment of the present invention. Referring to Fig. 1, the apparatus 100 for forming the image accesses a host computer 1, receives an image processing command such as a PDL created by the host 1, displays a target image data on an inner image memory, and prints the displayed image. Paper or OHP film can be used as a recording medium for print output. In Fig. 1, the apparatus 100 for forming the image includes a CPU 101, a cache memory device 102 (hereinafter, referred to as 'cache'), a read/write register 103, a ROM 104, a RAM 105, an image memory 106 for memorizing the displayed image data, photo ICs 107 and 108, a CPU bus 109 for connecting the above elements, a host I/F 110 for managing an interface with the host 1, and receiving the image data or control command from the host 1, a printer I/F 111 for outputting the image data to a color printer 200 by the command from the CPU 101, and the color printer 200 for forming the image on the basis of the input image data by using a laser beam. The image memory 106 includes four memory planes of cyan C, crimson M, yellow Y and black Bk.

**[0011]** In the above structure, the laser beam type color printer is used as the output device, which is not intended to be limiting. In this embodiment, the image is formed and printed according to the image processing command from the host 1. On the other hand, the present invention can also be embodied as a copier for connecting an image scanner to the host 1,

processing an image data from the image scanner by the host computer 1, and outputting the image data to the printer as shown in Fig. 1.

[0012] The CPU 101 performs a command interpreting process for discriminating whether the data from the host computer I/F 110 is the image data or the control command on the basis of a control program stored in the ROM 104, and outputting a necessary command to the corresponding element of the apparatus, a first image generating process for generating an image on the image memory 106 by the command C1, a second image generating process for generating an image different from the image generated by the first image generating process in the image memory 106 by another command C2, and an output process for sending a command C3 to the printer I/F 111 to output the image data displayed on the image memory 106 to the color printer 200. Whenever receiving the image processing command from the host computer 1 through the host computer I/F 110, the first and second image generating processes execute the image processing command, and display the final images on the corresponding image memory 106, respectively.

[0013] [First embodiment (Figs. 2 to 6)] The command interpreting process executed by the CPU 101 of the apparatus 100 for forming the image will now be explained with reference to the flowchart of Fig. 2. Here, it is presumed that the image processing command, for example, 'display 8 dotsx8 dots of black square' is inputted through the host computer I/F 110.

[0014] In step 10, whether the received image processing command is an image generating command is confirmed. If the received command is the image generating command, the routine goes to step 15, and if not, the

routine goes to step 40. In step 15, an image color is examined by interpreting the image processing command. If the image color is black, the routine goes to step 20, and if not, the routine goes to step 30.

[0015] When the command is the image processing command, 'display 8  
5 dotsx8 dots of black square', in step 20, a command 'generate a single black square in a designated size (in this case, 8 dotsx8 dots)' is applied to the first image generating process. Thereafter, in step 25, a command 'generate a black square smaller than a designated size (in this case, 6 dotsx6 dots) by using four colors (Y, M, C and Bk)' is applied to the second  
10 image generating process. When the commands of steps 20 and 25 are generated and executed by the first and second image generating processes, the image data of Fig. 3 is displayed on the memory planes of the image memory 106. The image data of Fig. 4 is displayed on the memory planes of the image memory 106 to be overwritten. As a result, the image of Fig. 5  
15 is displayed on the image memory 106. That is, the periphery of the image displayed black by the command from the host computer 1 is displayed single black, and the other part of the image is displayed dark black by the four colors such as cyan, crimson, yellow and black.

[0016] Fig. 6 is an exemplary diagram illustrating a process for generating  
20 a black font of a character pattern 'A'. That is, an image of Fig. 6(a) is displayed on the image memory 106 by the first image generating process, an image of Fig. 6(b) is displayed on the image memory 106 by the second image generating process, and an image of Fig. 6(c) is finally displayed on the image memory 106.

25 [0017] In step 15, when the image color is not black, the routine goes to

step 30. Here, a command 'generate a square in a designated color with a designated size (in this case, '8 dots x 8 dots') is applied to the first image generating process.

5 [0018] By the above procedure, the image data is displayed on the image memory 106 by the command from the host computer 1.

[0019] In step 10, if the image processing command is not the image generating command, the routine goes to step 40. In step 40, whether the command inputted from the host computer 1 through the host computer I/F 120 is a command 'output the image to the printer' is confirmed. In the  
10 command interpreting step, if the command is the printer output command, the routine goes to step 45. The CPU 101 outputs the print output command to the printer I/F 111. As a result, the image data is read from the image memory 106, and outputted to the color printer 200 through the printer I/F 111. In the case of another command, the routine goes to step 50  
15 to perform the corresponding process.

[0020] Accordingly, in this embodiment, when a white character is displayed on a black character or a black background, the contour is printed single black, and the black-designated part inside or outside the contour is printed with three colors of crimson M, cyan C and yellow Y.

20 [0021] [Second Embodiment (Figs. 7 to 8)] In the first embodiment described above, the contour of the black image is displayed single black, and the black-designated part inside or outside the contour is displayed dark black by using four colors. In this embodiment, a process for printing an image by minimizing paper folds by dispersion of the toner or spreading  
25 of the ink is described in the case that the image is printed dark black by

using four colors.

[0022] The basic concept of the present invention is to control the used color in the black-designated part inside or outside the contour of the black image without using all toners or inks such as crimson M, cyan C, yellow Y and black Bk. The procedure of the second embodiment is identical to that of the first embodiment except for step 25. Thus, step 25 will now be explained.

[0023] For example, when receiving a command 'display 8 dotsx8 dots of black square' from the host computer 1 through the host computer I/F 110 as in the first embodiment, the CPU 101 interprets the command as 'generate a black square which is smaller than a designated size (in this case, '6 dots x 6 dots') and which applies similar gradation to one dot by using three of the four colors', and applies the command to the second image generating process. When the second image generating process displays the image data on the image memory 106 by the command, the image data is added to the result of the first image generating process of Fig. 3. The image data of Fig. 7 is displayed on the image memory 106 to be overwritten, and thus the image data of Fig. 8 is finally displayed on the image memory 106.

[0024] In accordance with the present invention, the black toner ink output and the similar gradation output using two of the three colors, cyan C, crimson M and yellow Y are performed on the black-designated part (pixel) inside or outside the contour of the black image. As a result, the black output having appropriate concentration is obtained, reducing the whole discharge amount of the toner ink.

[0025] [Third Embodiment (Figs. 9 to 11)] The printer which can output

two values in each color element has been explained in the first and second embodiments of the present invention. In this embodiment, a printer which can use various values of data in each color element is described. Here, the various values of data have 256 step gradation, and the concentration thereof is represented by 16 hexadecimal (00 to FF) in Figs. 9 to 11.

[0026] The procedure of the third embodiment is identical to those of the first and second embodiments except steps 20 and 25 of the command interpreting process. Therefore, steps 20 and 25 will now be explained.

[0027] For example, when receiving a command 'display 8 dots x 8 dots of black square' from the host computer 1 through the host computer I/F 110 as in the first embodiment, in step 20, the CPU 101 interprets the command as 'display a single black square in a designated size (in this case, 8 dots x 8 dots) with maximum concentration (FF)', and applies the command to the first image generating process. In step 25, the CPU 101 interprets the command as 'display a square smaller than a designated size (in this case, 6 dots x 6 dots) with maximum concentration (FF) of black and intermediate concentration (7F) of cyan C, crimson M and yellow Y', and applies the command to the second image generating process.

[0028] When the first image generating process and the second image generating process display the image data on the image memory 106 by the commands, the image data of Fig. 9 is displayed on the image memory 106 by step 20, and the image data of Fig. 10 is displayed on the image memory 106 by step 25. Therefore, the image data of Fig. 11 is finally displayed on the image memory 106.

[0029] In this embodiment, the maximum concentration (FF) output using

the black toner ink and the intermediate concentration output using the toner inks such as cyan C, crimson M and yellow Y are performed on the black-designated area inside the contour of the black image.

[0030] As discussed earlier, in accordance with the present invention, the apparatus for forming the image which receives the PDL from the host computer and displays and prints the image can output the black characters without causing color non-uniformity to the character contours. In addition, in the second and third embodiments, the concentration of the black characters can be maintained to prevent paper folds by dispersion of the toner or ink.

[0031] The present invention can be applied to the system including a plurality of apparatuses or the system including only one apparatus. Also, the present invention can be applied to the system achieved by programs.

[0032] The laser beam printer has been applied to the apparatus for forming the image commonly used in the three embodiments of the present invention, which is not intended to be limiting. That is, an inkjet printer explained below can also be applied to the present invention.

[0033] [Brief Description of Inkjet Printer (Fig. 12)] Fig. 12 is a schematic diagram illustrating an inkjet recording apparatus IJRA that can be applied to the present invention. As illustrated in Fig. 12, a carriage HC engaged with a spiral groove 5004 of a lead propeller 5005 rotated by driving force transmission gears 5011 and 5009 by forward/backward rotation of a driving motor 5013 is reciprocated in arrows a and b directions with pins (not shown). An inkjet cartridge IJC is loaded on the carriage HC. Reference numeral 5002 denotes a paper pressing plate, for pressing paper to platen



5000 in a moving direction of a holder. Reference numerals 5007 and 5008 denote photo-couplers that are home position detecting means for confirming the existence in an area of a carriage lever 5006, and changing the rotation direction of the motor 5013. Reference numeral 5016 denotes a member for supporting a cap member 5022 covering a whole surface of a recording head. Reference numeral 5015 denotes a suction means for sucking the inside of the cap. The suction means sucks and recovers the recording head with a cap inside path 5023 therebetween. Reference numeral 5017 denotes a cleaning blade, and 5019 denotes a member for transferring the blade in the forward or backward direction, which are supported on a main body supporting plate 5018. The publicly-known cleaning blade can also be applied to this embodiment. In addition, reference numeral 5012 denotes a lever for starting suction of the suction recovery. The lever is transferred with a cam 5020 engaged with the carriage. The driving force from the driving motor is controlled by a publicly-known transmission means such as clutch variation.

[0034] When a reciprocating member reaches the home position area, the lead propeller 5005 can perform a target process such as capping, cleaning or suction recovery in a corresponding position. So far as the target process is performed in a publicly-known timing, all the processes can be applied to the present invention.

[0035] [Explanation of Control Structure of Inkjet Printer (Fig. 13)] The control structure for executing recording control of the apparatus will now be described with reference to Fig. 13. Reference numeral 1700 denotes an interface for inputting a recording signal, 1701 denotes an MPU, 1702

denotes a program ROM for storing a control program executed by the MPU 1701, 1703 denotes a dynamic ROM for preserving various data (recording signal, recording data supplied to a head, etc.), 1704 denotes a gate array for supplying the recording data to the recording head 1708, and controlling  
5 data transmission between the interface 1700, the MPU 1701 and the RAM 1703, 1710 denotes a carrier motor for returning the recording head 1708, 1709 denotes a returning motor for returning recording paper, 1705 denotes a head driver for driving the head, and 1706 and 1707 denote motor drivers for driving the returning motor 1709 and the carrier motor 1710, respectively.

10 [0036] The operation of the control structure will now be explained. When the recording signal is inputted to the interface 1700, the recording signal is converted into a recording data for printing between the gate array 1704 and the MPU 1701. The motor drivers 1706 and 1707 are driven, and the recording head 1708 is driven according the recording data transmitted to  
15 the head driver 1705, thereby performing the printing operation.

[0037] The constitutional elements of the present invention can be applied to the control structure of the inkjet printer. It is obvious that the present invention can be applied to the inkjet printer as well as the laser beam printer.

20 [0038]

[Effect of the Invention] As discussed earlier, in accordance with the present invention, when the image is formed by the command described by the PDL, whether the image is the black image is determined by interpreting the contents of the command. As compared with interpretation of the  
25 displayed image data, interpretation of the command rapidly obtains the

result. It is thus possible to more rapidly form the total image.

[0039] The black image area has a high quality by forming the image by using the black color element, forming the black image by using another color element inside the contour of the area, and forming the pseudo black image without using all color elements for color representation.

**[Description of Drawings]**

[Fig. 1] is a block diagram illustrating an apparatus for forming an image that is commonly used for the three representative embodiments of the present invention.

10 [Fig. 2] is a flowchart showing a command interpreting process in accordance with the first embodiment of the present invention.

[Fig. 3] is an exemplary diagram illustrating an image data displayed on an image memory by a first image generating process in accordance with the first embodiment of the present invention.

15 [Fig. 4] is an exemplary diagram illustrating an image data displayed on the image memory by a second image generating process in accordance with the first embodiment of the present invention.

[Fig. 5] is an exemplary diagram illustrating an image data display-ended on the image memory in accordance with the first embodiment of the present invention.

20 [Fig. 6] is an exemplary diagram illustrating a process for displaying a black character on the image memory in accordance with the first embodiment of the present invention.

[Fig. 7] is an exemplary diagram illustrating an image data displayed on an image memory by a second image generating process in accordance with

the second embodiment of the present invention.

[Fig. 8] is an exemplary diagram illustrating an image data display-ended on the image memory in accordance with the second embodiment of the present invention.

5 [Fig. 9] is an exemplary diagram illustrating an image data displayed on an image memory by a first image generating process in accordance with the third embodiment of the present invention.

[Fig. 10] is an exemplary diagram illustrating an image data displayed on the image memory by a second image generating process in accordance with  
10 the third embodiment of the present invention.

[Fig. 11] is an exemplary diagram illustrating an image data display-ended on the image memory in accordance with the third embodiment of the present invention.

[Fig. 12] is a schematic diagram illustrating an inkjet recording apparatus.

15 [Fig. 13] is a block diagram illustrating a control structure for executing recording control of the inkjet recording apparatus.

[Explanation of Reference Numerals] 1 host computer, 100 apparatus for forming image, 101 CPU, 102 cache memory device, 103 read/write register, 104 ROM, 105 RAM, 106 image memory, 107-108 photo IC, 109 CPU bus, 110  
20 host I/F, 111 printer I/F, 200 color printer